upon circumstances over which the physician has no control; if the patient has the constitution to withstand the toxemia he gets well; if not, he dies; but by hydrotherapy we enhance the patient's vital powers against the lethal agencies evolved in the infection process, thereby spurring on the central nervous system to furnish innervation for respiration, circulation, digestion, tissue building, and excretion, and bridging over the danger which would arise from failure of these functions.

THE SYMPTOMS OF DESCENDING THORACIC ANEURYSM.

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Aneurysms of the thoracic arch which reach any considerable size usually produce characteristic signs or symptoms. An abnormal pulsation, murmur, or area of dulness, a tracheal tug, or a left vocal paralysis immediately direct attention to the possible presence of an aneurysm, and the *x*-rays are called upon to contribute their important diagnostic aid. When the descending thoracic aorta is involved, however, signs and symptoms are very apt to be lacking, and when present they are frequently misinterpreted. In the cases that we have seen this has occurred almost uniformly. It seems advisable, therefore, to report our cases, calling special attention to the typical pains that have been so graphically described by Huchard.[1] Autopsies were obtained in but two of our six patients, yet the diagnosis in the remainder was made almost certain by the results of *x*-ray examination.

Case I.—W. T. H., a stableman, aged forty-two years, was first seen at the Cooper Medical Dispensary, San Francisco, on June 5, 1903, complaining of pain in the left side. The family history was negative. The patient had had the ordinary diseases of childhood, grippe in 1887, and gonorrhœa three or four times. He denied syphilis, but had always chewed tobacco and drank excessively. Since October, 1902, he had suffered from pain in the left side of the thorax, which was worse at night and kept him from sleeping. At times he had slight dyspnœa.

Examination showed a well-nourished man with a face indicative of overindulgence in alcohol. The pupils were equal and reacted normally. Both sides of the chest expanded poorly, but the left distinctly less than the right. The breath sounds were feeble and

[1] Maladie du cœur et de l'aorte, ii, 427.

distant, the expiration prolonged. No abnormal dulness or bruit over the back, and no friction sounds were found. The area of cardiac dulness was enlarged moderately to the right and left. The heart sounds were normal in character and intensity. The pulse was 110, equal and synchronous in both wrists. The radial arteries were moderately thickened. There was no tracheal tug.

On account of a distinct tenderness along the course of the fifth and sixth intercostal nerves a diagnosis of intercostal neuralgia was made and the ordinary remedies given. The patient returned occasionally to the dispensary for several months, always with the same complaint of pain in the left side. Repeated examinations by different members of the staff failed to discover any sign that would indicate the cause of the pain other than the tenderness over the nerves. After a few months the patient ceased coming to the dispensary.

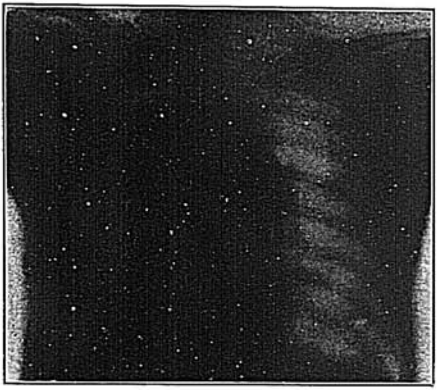

FIG. 1.—Skiagram of Case I.

On March 8, 1905, he returned again, complaining of his old symptoms. Again the examination was negative, except for very definite tender points to the left of the spinal column, in the left axilla, and to the left of the sternum. On account of the severity of his pain, he was sent to the Lane Hospital and was again treated for neuralgia. On April 6, 1905, a routine fluoroscopic examination was made by Dr. Lehmann. His note in part was as follows: "The transparency of the left lung is markedly less than that of the right. In the left side of the thorax there is a large shadow about the size of a child's head, which cannot be differentiated from the shadow of the aortic arch. This shadow is sharply outlined and apparently shows true pulsation. Viewed from behind, the shadow is more marked, clearer, darker, and smaller than when viewed from the front. The heart is in a pronounced horizontal position. The diaphragm on the right side moves 6 to 7 cm., on the left side only 3 to 4 cm." In veiw of these findings (Fig. 1), a diagnosis of aneurysm of the descending thoracic aorta was made. Two days later the patient began to cough up blood, and died within a few minutes.

The autopsy, performed by Dr. Ophüls, showed the heart to be normal. There was marked atheroma with many white retracted scars and moderate dilatation of the proximal portion of the aorta; less dilatation of the arch. At the distal end of the arch posteriorly a round opening about 4 cm. in diameter lead into an aneurysmal sac about the size of an apple. The aneurysm extended posteriorly and to the left, and had deeply eroded the spinal column. The aneurysm was adherent to the left lung, and had perforated into the upper posterior part of the lower lobe, which showed hemorrhagic infiltration. The lower thoracic and abdominal aorta showed very little atheroma.

CASE II.—C. W., aged sixty-one years, a veteran, came to the Cooper Medical Dispensary on January 3, 1908, complaining of stomach trouble. The family history was unimportant. The patient had always been strong and healthy. He had had jaundice in 1880, pneumonia in 1890, and a hard chancre about 1890, not followed by secondaries. He was treated with mercury and potassium iodide. He had had several attacks of gonorrhœa. He never drank excesssively. His present illness had begun five or six months before with a boring pain in the back. This pain had been more or less continuous and had often prevented his sleeping. About six months ago his stomach had begun to give him trouble for the first time. He suffered from epigastric pain, which seemed to be made worse by eating. He had vomited occasionally, but never vomited blood or material eaten on previous days. There was no difficulty in swallowing, and no jaundice, cough, or headache. There was slight dyspnœa on exertion. He was very constipated. He had lost 70 pounds in six months, and was very weak.

Examination showed an emaciated, pale, old man. The pupils were equal and reacted normally. The lungs were negative. There was moderate dilatation of the cutaneous veins across the upper left front of the thorax and left shoulder. Careful examination posteriorly and anteriorly failed to show any definite abnormal pulsation, dulness, or bruit. There was no tracheal tug. The heart was negative. The liver was slightly enlarged and palpable. There were no enlarged glands. Inflation of the stomach showed no dilatation. No abdominal tumor was felt either externally or by the rectum. The urine was negative. The blood showed a marked secondary anemia: red corpuscles, 3,750,000; hemoglobin, 66 per cent.; leukocytes, 8000, with a normal differential count. The stomach analysis showed an absence of free hydrochloric and of lactic acids; total acidity, 10; no retention of raisins taken the night before.

In this patient the recent onset of serious stomach trouble at the age of sixty-one, the rapid loss of weight, the secondary anemia, and the results of the stomach analysis led us to suspect a gastric carcinoma. The thoracic pain and the dilatation of the veins over the upper left chest and shoulder aroused a strong suspicion of metastases into the posterior mediastinum. An x-ray plate was therefore taken. Though rather poor and taken too low down, this sufficed to show a uniform round shadow above and to the left of the heart shadow (Fig. 2), characteristics which in connection with the symptoms led us to a diagnosis of an aneurysm of the descending thoracic aortic. As the patient left the city immediately after his exposure to the x-rays, it was not possible to reëxamine him. He died on January 27, 1908. The autopsy, performed at the Veterans' Home, Yountville, by Dr. A. H. Reinstein, showed that the cause of death was the rupture of an aneurysm of the descending thoracic aorta into the left pleural cavity. A carcinoma of the pylorus with metastases in the posterior lymphatic glands were also found.

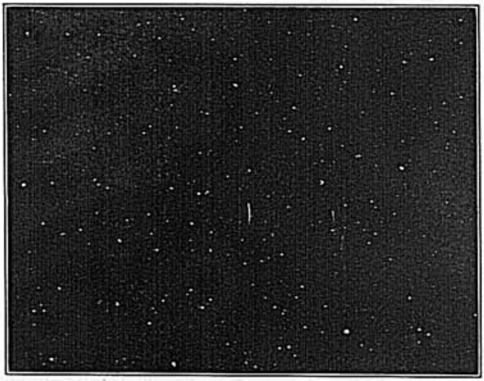

FIG. 2.—Skiagram of Case II.

CASE III.—C. A. B., aged fifty-one years, a paper hanger and decorator, entered the Lane Hospital on January 27, 1908, complaining of pain under the lower left scapula and in the epigastrium. The family history was negative except for the death of two brothers of tuberculosis. He had always been strong and healthy, never having had any of the acute infectious diseases since childhood. He had been a periodic drinker and had smoked excessively. He had gonorrhœa once. At twenty-one years he had what appears to have been a soft chancre without secondaries. The present trouble had begun about a year before, with constipation and dyspepsia. This had lasted a few weeks, then disappeared for a few months, and recurred for a few weeks. Three months ago the dyspepsia, constipation, and pain in the epigastrium had re-appeared, and have been present more or less continuously up to the time of admission. The pain had gradually grown worse. It was most marked in the epigastrium, but sometimes extended through to the left back. When the pain was severe the epigastrium was rather tender and felt drawn, as if a lump were present there. At times the pain was accompanied by belching of gas. The pain showed no definite association with the taking of food. It was most marked when the patient lay down or when he sat too long in one position. It was most severe at night, and often wakened him out of a sound sleep.

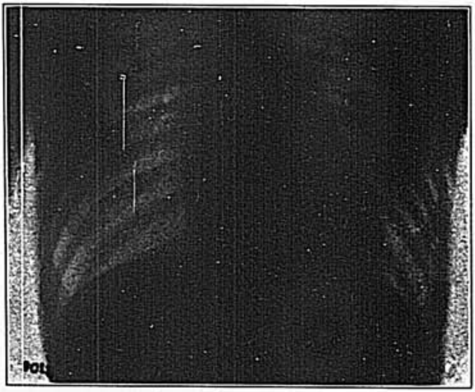

FIG. 3.—Skiagram of Case III.

Examination showed a well-developed but rather poorly nourished man. The pupils were equal and reacted normally. The lungs and heart were negative. There were no normal pulsations, no dulness, and no bruit over the back. Both sides of the chest moved symmetrically. Abdominal examination was negative, except for a slight rigidity of the upper left rectus muscle, which became more marked when the pain was severe. The urine and blood were normal. Repeated examinations of the feces for occult blood were negative.

Two stomach analyses gave approximately identical results: 60 c.c. of yellowish mucoid material, containing bits of undigested bread; total acidity, 18; no free HCl, no lactic acid, no occult blood, no retention of raisins taken the night before.

The pains were not relieved to any appreciable degree by careful dieting and the administration of acid. During his stay in the hospital they gradually became more severe, especially posteriorly at about the level of the tenth dorsal spine. The only circumstance which seemed to influence them definitely was posture. Whenever he lay on his back or left side the pains became worse. For this reason he usually slept lying face downward. Considerable tenderness to deep pressure was discovered over the eighth to eleventh dorsal spines. A zone of hyperalgesia to the scratch of a pin was found on the left side corresponding to about the distribution of the ninth and tenth dorsal nerves. This hyperalgesia was much more marked behind than in front. On account of the hyperalgesia and the effect of posture upon the pains, an *x*-ray plate was taken of the lower thorax (Fig. 3). This showed an abnormal shadow behind the heart apparently continuous with the shadow of the descending thoracic aorta. Dr. C. M. Cooper[2] agreed with us that the symptoms and *x*-ray examination taken together indicated that the patient was suffering from an aneurysm of the descending thoracic aorta.

Case IV.—O. K., aged thirty-eight years, a butcher, came to the Cooper Medical Dispensary on March 23, 1908, complaining of pain over the heart and between the shoulders. The family history was negative. While serving in the German army, at sixteen years he contracted gonorrhœa and at the same time had a chancre, followed by definite secondaries. He was treated with inunctions. He had been a hard drinker and a moderate user of alcohol. His present illness had begun three months before with pain over the heart and between the shoulders. These pains were very intense. They came on only when he lay on his back or on his left side, and not, as a rule, when he lay on his abdomen or right side. The pain was not influenced by exertion, coughing, or deep respiration. About one-half hour after lying down, he would be wakened by the pain, and relief could only be obtained by sitting up for a few minutes. If he again lay on his back, the pain invariably returned. He had had slight dyspnœa for fifteen years. There was no swelling of the feet, no cough, and no loss of the voice; appetite was good; the bowels were regular.

Examination showed a well-nourished and healthy-looking, though somewhat nervous, man. The pupils were equal and reacted normally. An indefinite tracheal tug could be felt when he lay recumbent and held a deep breath. The left side of the chest moved decidedly less than the right. There was no definite dulness, respiratory changes, or bruit over the back. The heart was negative, except for a moderate accentuation of the second aortic sound. The radial arteries were moderately thickened. There was no tenderness over the dorsal spines. An area of hyperalgesia to the pin scratch could be easily demonstrated to the left of the vertebral column, extending in a vertical direction from about the fourth to the eighth dorsal spines and laterally as a band around the left side of the chest (Fig. 4). This hyperalgesia was much more marked behind. In front it became narrower and less definite in outline. On account of the history of syphilis, the accentuation of the second aortic sound, the area of hyperalgesia, and the character of the pain, a probable diagnosis of aneurysm of the descending thoracic aorta was made. This was confirmed by flouroscopic examination, which showed a large pulsating shadow to the left of the spine, more distinct when viewed from behind than when viewed from the front, and plainly located in the back of the chest when the patient stood in an oblique position (Fig. 5). An aneurysm of the descending thoracic arch was, therefore, the cause of this patient's pain.

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[2] We are indebted to Dr. Cooper for this plate, as well as those of Cases II and IV.

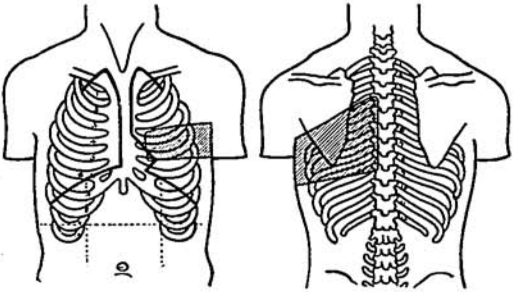

Fig. 4.—Hyperalgesic zone in Case IV.

Case V.—J. G., aged forty-one years, entered the medical ward of the University of Michigan Hospital on October 10, 1908, complaining of shortness of breath and of constant pain in the left side of the abdomen and back. The family history and past history were negative. He denied alcoholic excesses and venereal infection. The present trouble began about three years before with sharp pains in the left side, which lasted three days and were relieved by a lotion. After a couple of weeks the pains again returned and were again relieved by rubbing. These pains had continued off and on and with varying intensity since then. About a year before they had been so severe that he could not sleep for six weeks. They had been diagnosticated as pleurisy and intercostal neuralgia. He had also been moderately short of breath on exertion, and at times had suffered from palpitation.

In the ward the patient was usually found on his left side, which position afforded him relative relief from his pains. His pupils were equal and reacted well on accommodation, but not to light. There was no tracheal tug. The left chest lagged on inspiration, especially in its lower part. There was some impairment of resonance over the left lower chest behind, from about the sixth spine down, accompanied by diminished breath sounds. Indefinite systolic pulsation was noted on some occasions just to the left of the eighth spine. Below this a fair Broadbent sign could be seeen at times. Over the area of pulsation the heart sounds were heard exceptionally well, but there were no murmurs.

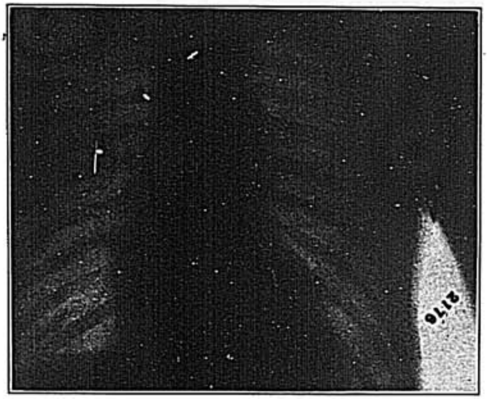

FIG. 5.—Skiagram of Case IV.

The apex beat was rather diffuse, but could be distinctly felt as far as 14.5 cm. to the left of the median line in the fifth intercostal space. In the recumbent posture a systolic thrill was felt in the third left intercostal space. The area of cardiac flatness was decidedly enlarged, extending from the middle of the sternum to within 1 cm. of the left mammary line. It joined the liver flatness by an obtuse angle. The area of cardiac dulness extended 15 cm. to the left of the median line and 5 cm. to the right. It was continuous above with a broad area of dulness, which extended upward on either side of the sternum to the clavicle. At the apex one heard a slight blowing systolic murmur and an indefinite diastolic rumble, the latter being sharply limited to the region of the apex beat. Toward the sternum the systolic murmur became louder, reaching its maximum in the third intercostal space 5.5 cm. from the median line. Here it was an exceedingly rough and intense murmur. This murmur was transmitted over the left chest upward as far as the second rib and outward as far as the anterior axillary line. It was barely heard beyond the right border of the sternum and not heard in the vessels of the neck. It was faintly heard over the left back opposite the second dorsal spine. In front the murmur became less loud during deep inspiration and when the patient sat up. It varied in intensity from time to time, but, on the whole, was very constant. The pulmonary second sound was accentuated and at times could be felt as a distinct shock. The knee-jerks and ankle-jerks were absent. The urine and blood were negative.

One of the most striking features of the patient's examination was the zone of disturbed sensation which extended around the left side

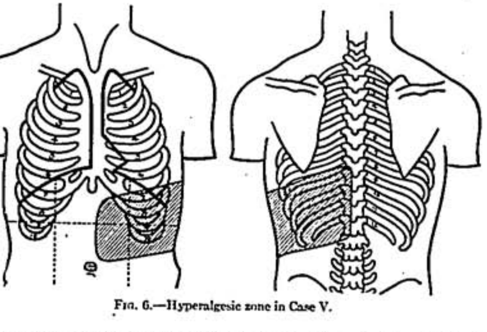

FIG. 6.—Hyperalgesic zone in Case V.

from the spine to the median line in front. It varied in width, but was most constant between the levels of the eighth and twelfth dorsal spines behind and the ensiform and umbilicus in front (Fig. 6). At first there was everywhere extreme hyperalgesia to the pin scratch and to pressure, but later the anterior portion of the zone showed anesthesia to the touch of the camel's-hair brush and was associated with hyperalgesia to the pin scratch. On November 29 a slight weakness of the upper left rectus muscle was noted, but this later became less marked.

During his stay in the hospital the patient suffered more or less continuously from pain in the left side. When this was severe he always lay on this side, other positions being impossible on account of pain. When the pain was less severe he occasionally walked about the ward, but one gained the impression that such exertions were often succeeded by renewed exacerbations of the pain.

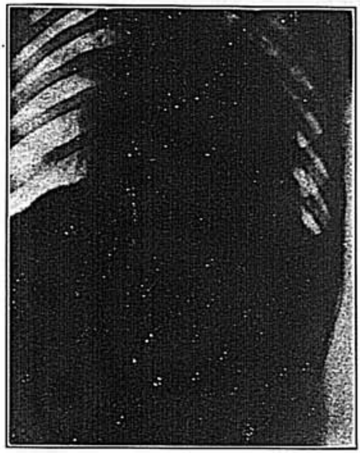

Fig. 7.—Skiagram of Case V taken in a sagittal direction.

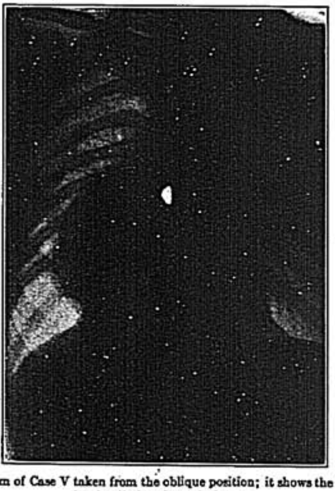

Fig. 8.—Skiagram of Case V taken from the oblique position; it shows the left aneurysmal border distinct from the heart.

The x-ray examination showed an abnormal shadow behind the heart. If the patient, facing the flouroscopic screen, were rotated to the right, this abnormal shadow could be seen moving to his left while the heart moved to his right, thus demonstrating its position behind the heart. Plates taken from two directions (Figs. 7 and 8). illustrate this. The smooth rounded outline of this posterior shadow, together with some pulsation, indicated that it was caused by an aneurysm of the descending thoracic aorta situated behind the heart. The crowding of the heart forward undoubtedly accounted for some of the abnormal cardiac signs and rendered it difficult to determine just what other factors came into play, though probably the loud systolic murmur over the pulmonary area was due to a partial obstruction of the pulmonary artery or its left branch. The patient had tabes dorsalis, and one might question whether his pains and disturbed sensation were due to the aneurysm or to the tabes. As the site of these nervous disturbances corresponded to that of the aneurysm, it seems probable that the latter was their cause.

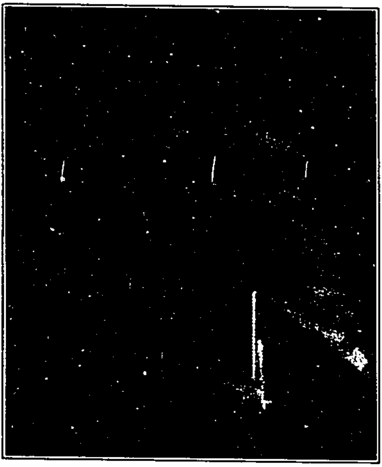

FIG. 9.—Skiagram of Case VI.

CASE VI.—W. B., aged sixty-four years, had entered the medical ward of the University of Michigan Hospital on several occasions suffering from arteriosclerosis, dilated heart, and chronic nephritis. He had the ordinary symptoms of broken compensation together with Cheyne-Stokes breathing. The discovery of his aneurysm was purely accidental. A plate taken to determine the heart outlines showed a rounded shadow which arose from the middle shadow at the upper level of the aortic arch and described an arc well outside the left sternal margin until it intersected the heart shadow (Fig. 9). Fluoroscopic examination of this abnormal shadow showed that it pulsated, and by rotating the patient on a revolving stool, that it was situated in the posterior portion of the chest. It was more clearly seen from behind than from in front. The patient showed no deformity of his chest. We must conclude that this was a fusiform aneurysm of the descending thoracic aorta. Apparently it produced no symptoms whatever. Neither could signs be found which were definitely referable to the aneurysm, with the possible exception of bronchovesicular breathing in the left axilla. This might have been due to compression of the lung.

A review of these six cases of descending thoracic aneurysm allows us to divide them roughly into two groups. In the first, which is represented by the first five cases, the main symptom was pain; in the second group, represented by the last case, no symptoms whatever were present. There are numerous instances in the literature of the accidental discovery of unsuspected aneurysms. This occurred in 5 per cent. of the 104 aneurysms reported by Baetjer.[3] It happens so frequently when the aneurysm arises from the descending thoracic aorta that Huchard[4] speaks of this as the zone latente des aneurysmes meconnus, des erreurs de diagnostic. Such aneurysms may reach a large size without giving rise to any symptoms previous to their final rupture into the lung, bronchus, esophagus, pleural cavity, or mediastinum.

The remaining five cases may be grouped together, the main symptom being pain. In our patients this pain, though varying from time to time, was, on the whole, of extraordinary severity. Its situation in the individual patient was practically constant, and it was remarkably resistant to all forms of medication. In one patient the pain was of a dull, boring character and located in the centre of the back. In the other four it was limited to the left side of the thorax and was of a neuralgic type, with either typical tender spots or a zone of cutaneous hyperalgesia. The latter was present in three patients, and in one of these (Case V) it was associated at times with anesthesia to the touch of the camel's-hair brush. Such a dissociated sensory disturbance caused by the pressure of an aneurysm upon the intercostal nerves has been described in detail by Frick.[5] In one of our patients there was a spasm of the upper left rectus muscle, which increased when the pains were severe; in another there was at times a paresis of this muscle. In all the cases of this group the pain showed pronounced nocturnal exacerbations. In three this was a distinctly postural effect, for the pain was accentuated when the patient lay on his back. One patient slept on his face, another on his left side, while a third had to sit up in order to be relieved of the pain. In two of our patients the main pain was referred to the front of the body; in Case IV, to the heart, simulating angina pectoris, and in Case III, to the upper abdomen. Such referred pain may lead to the mistaken assumption that a viscus is diseased and that the tenderness or hyperalgesia behind is a Head's area. Thus, in Case III, with epigastric pain, spasm of the left rectus muscle, and tenderness behind, it was at first believed that the pain originated in the upper abdomen. This patient had been sent into the hospital for an exploratory operation, which might have been performed in the attempt to locate the pain had not the *x*-ray examination demonstrated an inoperable condition. Similar pseudogastric pains have been noted by others (Rendu[6]); and Baetjer recites a somewhat analogous history of a patient in whom a gallstone operation had actually been performed with negative findings three years before the *x*-rays finally showed that a large aneurysm of the descending thoracic aorta was the cause of symptoms. Milanoff[7] found histories of three patients who had been treated for renal colic. These abdominal pains are particularly apt to be caused by aneurysms situated just above the diaphragm. They are common enough also in abdominal aneurysms. A patient recently sent into the Lane Hospital was supposed to be suffering from biliary colic or a duodenal ulcer, but the exploratory operation showed an aneurysm of the upper abdominal aorta.

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[3] The X-ray Diagnosis of Thoracic Aneurysms, Johns Hopkins Hospital Bulletin, 1906, xvii, 24.

[4] Loc cit, p. 413.

[5] Ueber objective nachweisbare Sensibilitätsstörungen am Rumpfe bei Aneurysma Aortæ, Wien. klin. Woch., 1901, No. 25.

The neuralgic pains present in four of our patients were evidently due to some damage to the intercostal nerves. Whether they were due to pressure alone or, as many clinicians believe, to a chronic inflammation in the neighborhood of the aneurysmal sac is difficult to decide. The pain referred to the front of the body, the zones of disturbed sensation, and the spasm or paresis of the muscles evidently could not be accounted for by other factors sometimes held responsible for aneurysmal pains, such as erosions of the bone or disease of the vessel wall.

From our experience pain is the most frequent symptom of descending thoracic aneurysm. Milanoff, who collected the histories of 120 patients with this disease, found pain mentioned in 72 of them, whereas dysphagia occurred in 20, hematemesis in 13, hemoptysis in 21, left pleural effusion in still fewer. Andréef[8] could collect but 8 cases of paraplegia from this cause. When one remembers that most of these symptoms, with the exception of pain, occur late in the disease, the great importance of pain as an early symptom of descending thoracic aneurysm becomes apparent. In some instances it has lasted ten or even twenty years.

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[6] Cited by Milanoff.

[7] Etude de la douleur et de quelques autres symptomes des anévrismes de l'aorte thoracique descendante, Thèse de Paris, 1900.

[8] Contribution à l'étude des anévrismes de l'aorte descendante, Thèse, Toulouse, 1904.

The physical signs of aneurysm of the descending thoracic aorta are of such an indefinite character that only exceptionally can one make a diagnosis from signs alone previous to erosion of the bony thorax. In none of our patients was a murmur heard over the site of the aneurysm, though listened for in every case. In Case V, in which a large aneurysm was situated directly behind the heart, the heart sounds were heard with unusual distinctness over the site of the aneurysm. Slight pulsation with some dulness over the left back were also found in this patient; in the remainder all these signs were absent. Two patients showed indications of pulmonary compression, diminished breath sounds in one and bronchovesicular breathing in the other, but as both had large hearts it was difficult to be certain that the aneurysm was the sole cause of the signs. In three patients a diminished mobility of the left side of the thorax was noted, and in one of these a lessened excursion of the left side of the diaphragm was seen with the fluoroscope. In two patients there was sensitiveness of the dorsal spines, and in three a zone of disturbed sensation around the left side of the body.

The great value of x-ray examinations is apparent in such cases as these. One is often astounded to see the size of the aneurysm that has escaped detection by the ordinary methods of physical examination. The difficulties encountered in the interpretation of x-ray findings[9] are certainly negligible compared with the difficulties surrounding the use of ordinary methods of diagnosis.

As a result of our experience with aneurysms of the descending thoracic aorta we cannot do better than quote the words of Huchard when he speaks of aneurysmal neuralgias: "When one is dealing with symptoms of pain characterized by their persistency, their long duration, their intensity, when they remain unexplained, when they resist all ordinary medication, finally, when they present certain special characteristics, such as a fixed location or a diminished severity in certain attitudes of the patient, then we are not dealing with true neuralgia, as is too frequently assumed. In such cases one should consider aneurysm as a probable diagnosis, and if no tumor is perceptible as yet, one should turn to the x-rays in order to obtain certain proof."

[9] Sewall and Childs, The Interpretation of X-ray Pictures as an Aid to the Early Diagnosis of Thoracic Aneurysm, Amer. Jour. Med. Sci., 1907, cxxxiv, 360.